Electricity from the sun

Solar power systems for schools

Clean Energy Council

1st Edition, February 2009

Clean Energy Council

Australian Government

Department of the Environment, Water, Heritage and the Arts

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Clean Energy Council
18 Kavanagh Street
Southbank Victoria 3006
Australia
Phone: 03 9929 4100
www.cleanenergycouncil.org.au

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Major contributors
Brad Shone, Alternative Technology Association (ATA)
Geoff Stapleton, Global Sustainable Energy Solutions
Mike Russell, Clean Energy Council
Nigel Wilmot, Research Institute for Sustainable Energy (RISE)

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The information in this booklet has been provided as a guide to solar power systems.

While every effort has been made to ensure the content is useful and relevant, no responsibility for any purchasing decision based on this information is accepted by the Clean Energy Council or other contributors.

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The Australian Government National Solar Schools Program supports the installation of solar and other renewable power systems and energy measures at schools.

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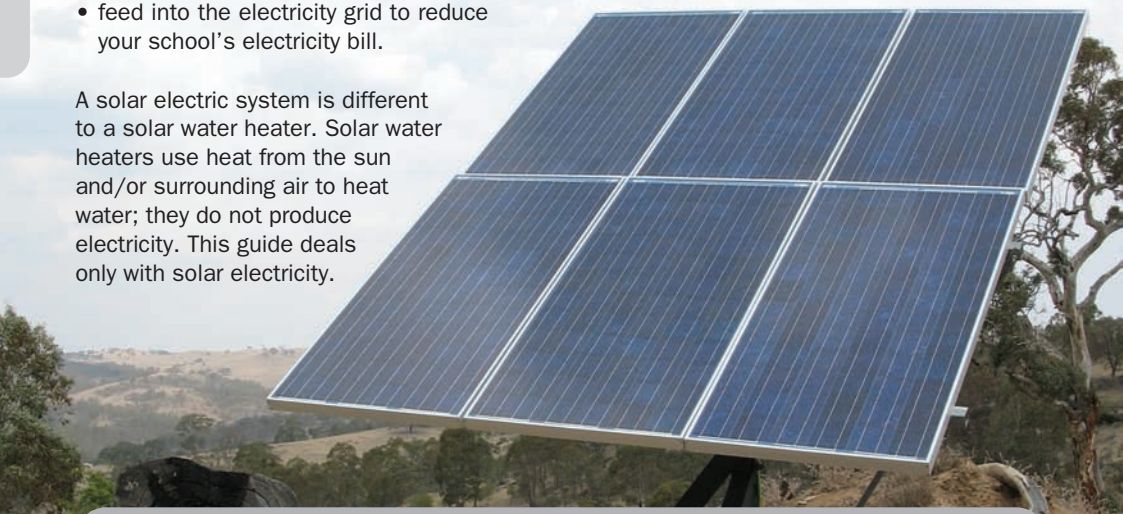
Solar power systems

The aim of this booklet is to provide some background information to assist schools in making an informed choice about solar photovoltaic power systems.

Solar power systems:

- use sunlight to generate electricity for your school's use, and
- store excess electricity in batteries for later use, or
- feed into the electricity grid to reduce your school's electricity bill.

A solar electric system is different to a solar water heater. Solar water heaters use heat from the sun and/or surrounding air to heat water; they do not produce electricity. This guide deals only with solar electricity.



How solar power systems benefit schools:

- ☑ Solar power systems **generate electricity**
- ☑ Once the system has been purchased, electricity is generated from **a 'free' resource**—the sun
- ☑ Solar electricity is generated **without emitting greenhouse gases**
- ☑ Solar panels or modules are **silent**, without any moving parts
- ☑ Solar modules are generally mounted on an existing roof
- ☑ Solar modules can be **integrated** into the building in the form of windows, walls, roof tiles or pergolas
- ☑ Solar electricity can supplement or provide a **school's electrical consumption**
- ☑ Solar electricity can be **fed into the grid**
- ☑ Additional solar modules can be **added later** as demand or budget grows
- ☑ Solar power systems should last for at least **20–30 years**.

Solar modules

Solar modules are generally flat panels mounted on roofs or other structures.

Solar modules convert energy from sunlight into direct current (DC) electricity.

More energy is generated

- in areas of strong solar radiation
- on long, sunny days.

Less energy is generated

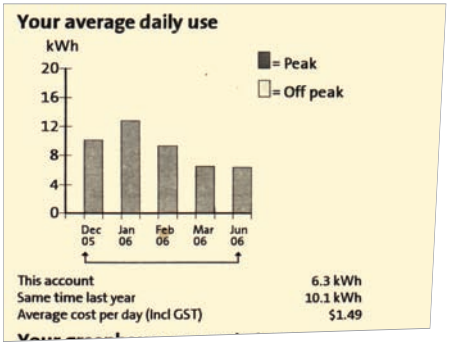
- in cloudy or rainy weather
- when the panels are shaded by trees or other obstructions
- when the panels become hot.

The right system

Factors to consider:

- school **electricity demand—**how much your school uses. The more electricity your school demands, the larger the system and the greater the cost
- **school budget—**how much is your school prepared to invest? Your budget may create limits on the size of the system
- **school location—**whether the mains electricity grid is available and if there are any costs that your school must meet in bringing power out to your school and maintaining of poles and cables on your school grounds
- **aspect—**there needs to be sufficient space on your school's roof to mount north-facing modules
- **grants and rebates—**Commonwealth, state and territory grants and rebates provide an incentive for schools to invest in solar. These are subject to change from time to time. Please check with the Australian Government Department of the Environment, Water, Heritage and the Arts or your local accredited designer/installer.

Note: To be eligible for existing rebates, your system must be designed and installed by a BCSE accredited installer.



The above bill shows a peak daily consumption of 12.5kWh in January 2006. June 2006 was 6.3kWh per day.

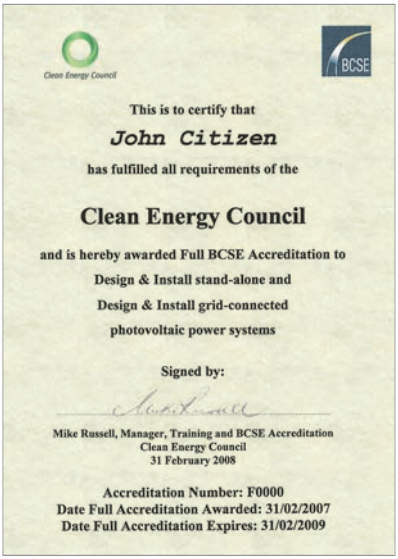
A designer/installer

BCSE accreditation ensures that those holding accreditation:

- ☑ have undergone the necessary **professional training**
- ☑ follow **industry best practice**
- ☑ must **adhere to Australian Standards**
- ☑ routinely **update their skills and product knowledge.**

It is also wise to:

- consider the recommendations of others who have purchased a similar system to the one your school requires
- engage someone who is BCSE accredited that your school is happy to work with, and
- look for designing and installing experience in the industry, not just a retail outlet.


Clean Energy Council

BCSE

This is to certify that

John Citizen

has fulfilled all requirements of the

Clean Energy Council

and is hereby awarded Full BCSE Accreditation to
Design & Install stand-alone and
Design & Install grid-connected
photovoltaic power systems

Signed by:

Mike Russell, Manager, Training and BCSE Accreditation
Clean Energy Council
31 February 2008

Accreditation Number: F0000
Date Full Accreditation Awarded: 31/02/2007
Date Full Accreditation Expires: 31/02/2009

Stand alone or grid connected?

Is the mains electricity supply available at an affordable price?

Yes →

No →

If **Yes** then you should consider a grid-connected power system

See page 7 →

If **No** then you should consider a stand-alone power system

See page 17 →

A: Grid-connected solar power systems

If your school…

- is interested in renewable energy
- would like to reduce its power bill
- wants to help the environment
- wishes to show its students what a solar power system is
- wants to export any excess solar power

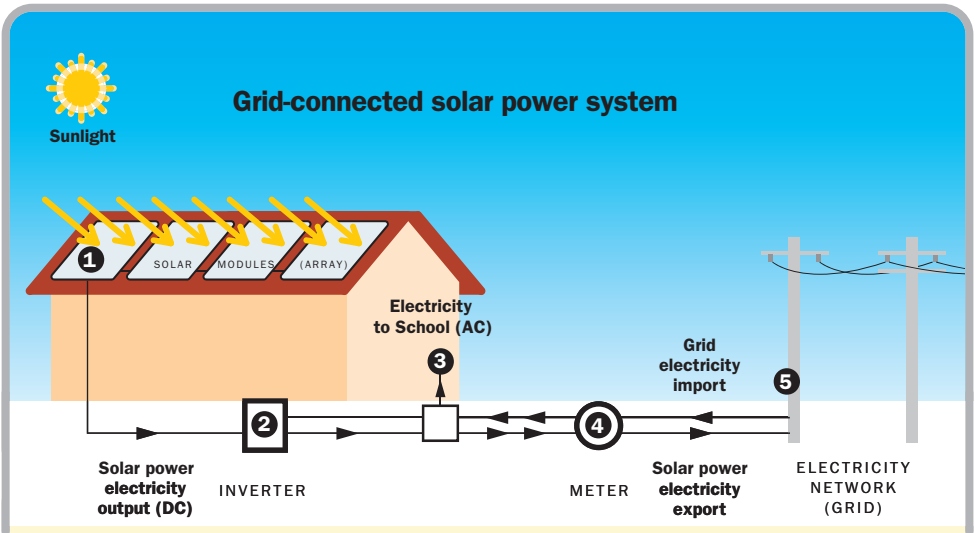
then…

a grid-connected solar power system may be for your school.

A grid-connected solar power system

A grid-connected solar power system is an array of photovoltaic (PV) modules connected via an inverter to provide power for your school, with excess production feeding into the grid.

At night, when the solar modules are not producing electricity, the electricity comes to your school from the grid. If your school exports enough energy during the day, it will balance or exceed the amount you draw from the grid at night.



❶ **Solar modules** supplying DC power.

❷ An **inverter** changing the solar DC power into 240V alternating current (AC) suitable for your school's equipment and appliances and feeding into the grid.

❸ Your **school** uses electricity firstly from the solar PV modules with additional demand supplied from the grid.

❹ A **meter** measuring your electricity production and consumption.

❺ Any excess is 'exported' to the electricity grid.

System size

While the ideal outcome is to provide enough energy to run your school's electrical appliances year round, the reality is that your school's electricity usage and budget may not always match.

Often the solar power system will supply only part of your school's total electricity demand, however, your school can always add to the system.

If your school can minimise electricity consumption, and is able to purchase a large system, your school may be able to meet all or most of your electricity demand. Therefore your school's ongoing electricity bills could be close to zero.

If your school uses a lot of electricity, and is only able to purchase a small system, the saving on your school's electricity bill will be not as great.

For this reason, your school may wish to consider some energy efficiency measures to reduce electricity consumption, and replace a larger portion of your school's electricity bill with a solar power system.

What will I need to power a school?

There's no easy answer to this question.

Everyone's electricity usage is different—it depends on:

- patterns of **energy use** in your school
- number of **students and teachers**
- types of **appliances and equipment.**

The size of the system will depend on:

- the physical un-shaded **space available** to install the modules that will make up your school's solar power system
- how much **funding your school has to invest**
- what portion of your school's electrical demand you wish to generate.

Reducing demand

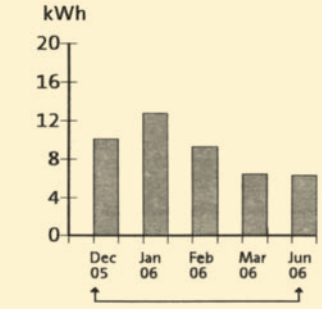
While the solar power your school generates can help offset electricity charges, it is important to consider other cost-effective alternatives.

These alternatives include:

- using the most **energy efficient appliances**
- **replacing incandescent light globes** with compact fluorescent lamps
- **avoiding quartz halogen downlights** as most are very inefficient
- **switching off stand-by loads** such as those consumed by DVDs and computers when not in use
- installing a **solar hot water heater**
- utilising **motion sensors**, timers and automation systems

- positioning **summer shading** on west facing windows
- **reducing electricity demand** for space heating and cooling (eg: by dressing for the climate, judiciously setting thermostats, incorporating energy efficiency features into school buildings, such as energy efficient lights, insulation, summer shading that can retract in winter etc), and
- ensuring there's adequate **solar access in winter** to provide passive heating.

Your school's average daily use



This account	6.3 kWh
Same time last year	10.1 kWh
Average cost per day (Incl GST)	$1.49

Your school's greenhouse gas emissions

The most common and accurate method used to determine your school's energy usage is to review your electricity supply bills for the past 12 months and calculate average annual daily consumption. Use the bar graph to calculate your school's annual average daily use. Your school can then compare this with the production figures, for your location, on page 13.

Meters

Left: Modern digital meter
Right: Old-fashioned meter

There is a range of meters available for different purposes, including the meter on an inverter that measures the amount of energy produced by a solar power system and a billing meter that measures the electricity consumed from the grid.

The educational benefits of electricity production and consumption data is maximised when they are linked to a prominent display and an interactive web-based tool.

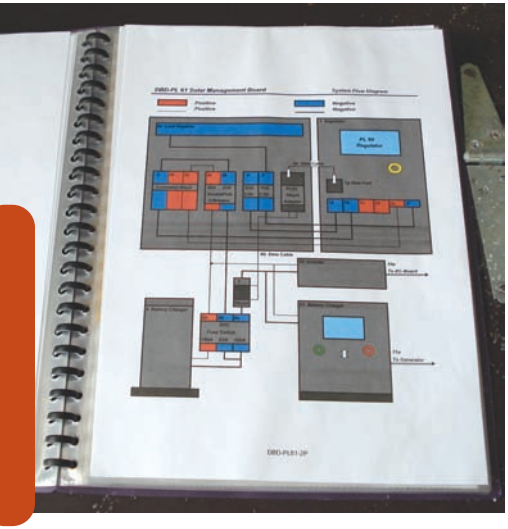
When the grid goes down

For safety reasons, when the grid goes down your school's solar power system must automatically and immediately turn off.

It is possible to have a system that will provide emergency electricity when the grid is interrupted. This necessitates the additional installation of a suitable inverter, a battery bank and possibly changes to your school wiring. The benefit is it will provide the security of a continuous electricity supply in the event of blackouts.

Design

A BCSE accredited designer will provide your school with the system design and specification.



The system designer will:

- determine the **configuration** and number of solar modules
- select an appropriate **inverter**
- determine whether the solar modules will fit on the **roof or structure**
- determine constraints caused by **shading**.

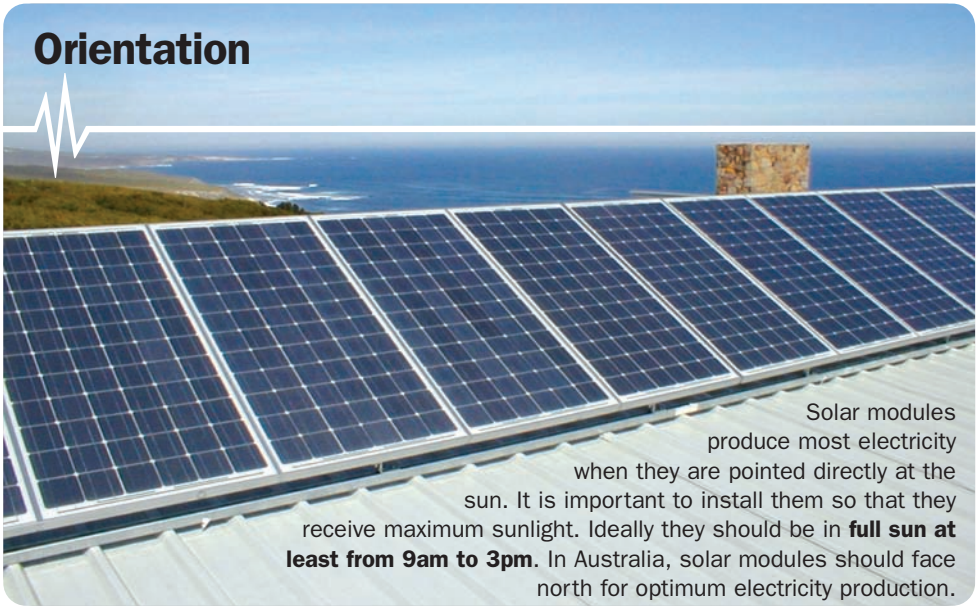
Location

The system's location requires consultation with your accredited installer.

Suitable areas are required for the solar modules and the inverter. For example:

- The solar modules may be fixed onto the roof (or a ground-mounted frame). **For best performance, a north facing area, free from shading, is recommended**.
- The inverter should not be exposed to the elements, though weatherproof models are available.

Orientation

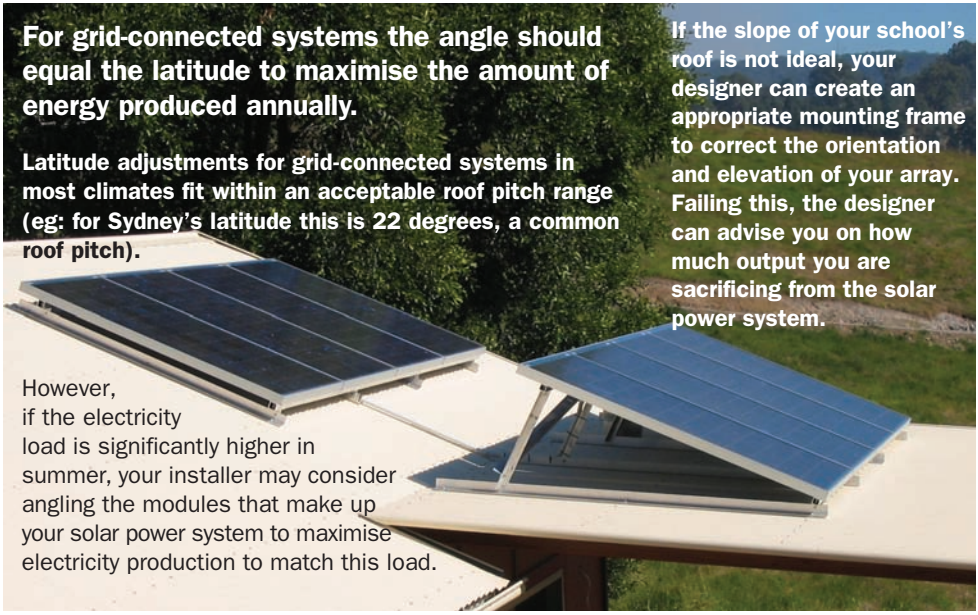


Solar modules produce most electricity when they are pointed directly at the sun. It is important to install them so that they receive maximum sunlight. Ideally they should be in **full sun at least from 9am to 3pm**. In Australia, solar modules should face north for optimum electricity production.

Elevation

For grid-connected systems the angle should equal the latitude to maximise the amount of energy produced annually.

Latitude adjustments for grid-connected systems in most climates fit within an acceptable roof pitch range (eg: for Sydney's latitude this is 22 degrees, a common roof pitch).



However, if the electricity load is significantly higher in summer, your installer may consider angling the modules that make up your solar power system to maximise electricity production to match this load.

Customisation

If the slope of your school's roof is not ideal, your designer can create an appropriate mounting frame to correct the orientation and elevation of your array. Failing this, the designer can advise you on how much output you are sacrificing from the solar power system.

Average daily production

The following figures indicate the average kilowatt hours (kWh) of energy your school can produce in one day from a 1 kilowatt (kW) grid-connected solar electric power system in various locations of Australia.

Electricity is metered in kilowatt hours (kWh) where 1kWh = 1000Wh. Hence if you use 1kW for 1 hour you have consumed 1kWh of energy. Some electricity retailers refer to 1kWh as 1 unit.

CITY	kWh
Adelaide	4.03
Alice Springs	4.56
Brisbane	3.85
Cairns	3.70
Canberra	3.97
Darwin	4.30
Geraldton	4.62
Hobart	3.24
Melbourne	3.38
Oodnadatta	4.66
Perth	3.71
Sydney	4.00
Tennant Creek	4.33
Wagga Wagga	4.06

Quotation

Following the design and specification you may request a quotation for the supply and installation of the system.

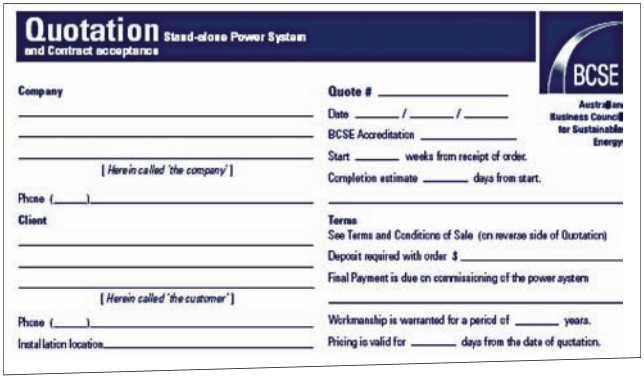
The **quotation** should provide specifications, quantity, size, capacity and output for the major components, including:

- solar modules
- mounting frames or structure
- inverter
- any additional metering or data logging
- travel and transport requirements
- other equipment needed
- any trench digging
- a system user manual.

The **quotation** should also specify a total price, together with proposed start and completion dates. The quotation should form a basis for your contract with the designer/installer.

In addition, a **contract** for the supply and installation of the power system should be included with the quotation.

Whilst the initial cost is very important, it is wise to consider all the costs and benefits over the life of the system, together with the service your school expects from the system designer and installer.



Quotation Stand-alone Power System and Contract acceptance

BCSE

Company

[Herein called 'the company']

Phone (____)

Client

[Herein called 'the customer']

Phone (____)

Installation location

Quote # _____

Date ____ / ____ / ____

BCSE Accreditation _____

Start ____ weeks from receipt of order.

Completion estimate ____ days from start.

Terms

See Terms and Conditions of Sale (on reverse side of Quotation)

Deposit required with order $ _____

Final Payment is due on commissioning of the power system

Workmanship is warranted for a period of ____ years.

Pricing is valid for ____ days from the date of quotation.

Sample of a typical quotation pad

The **contract** should include:

- an estimate of the average daily electricity output (in kWh)
- the estimated production in the best and worst months
- the responsibilities of each party
- warranties and guarantees, including installer workmanship
- the schedule of deposit and progress payments.

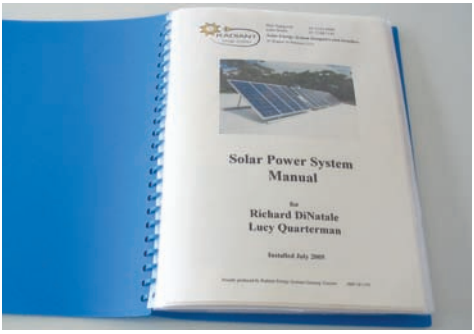
It is important to remember that a good relationship with a reputable, experienced, quality installer may be more valuable than a few dollars saved on a quote. The system will be a significant investment so you should ensure the decision you make is the best.

Eligible primary and secondary schools must select an accredited installer if they are applying for a grant from the Australian Government.

Australian Standards and industry guidelines

Solar grid-connected power systems must comply with a range of Australian Standards covering the grid connection of energy systems via inverters, the installation of solar modules and *The BCSE Design and Installation Guidelines*.

Documentation



A system manual that provides operation, maintenance and safety information should be provided by your installer. This must also include a design of the system. Also ensure your school obtains written confirmation of statements made by your installer, performance claims, guarantees and warranties.

Documentation will be essential when your school needs to make warranty or insurance claims.

Preventative maintenance

WARNING

DUAL SUPPLY
ISOLATE BOTH NORMAL AND SOLAR SUPPLIES BEFORE WORKING ON THIS SWITCHBOARD

After installation, the owner is responsible for ensuring the equipment is maintained in good working order.

Please note that appropriate instruction by the installer, backed up by maintenance information in the system manual, should be provided. Safe work practices for any maintenance tasks must be followed.

For further information on the future maintenance of your system please refer to the BCSE's guide "Solar PV Systems Maintenance Guide For System Owners" ISBN: 978-0-9802806-9-2.

SOLAR SUPPLY

Electricity distributors

All poles, lines and meters are provided by an electricity distribution business. You cannot choose your distributor as they are allocated geographically throughout Australia.

Electricity retailers

Electricity itself is sold to or bought from your school by an electricity retailer. In most states and territories your school can choose a retailer although not all will agree to sell or buy from a solar powered generator.

It is important to shop around for the best deal including buying rates and conditions.

Before signing with a retailer, check all the following:

- ☑ Cost of electricity your school purchases in cents per kWh
- ☑ Price they will pay per kWh for electricity your school will feed into the grid
- ☑ Whether your school's meter registers the total production from your school's solar power system or just the excess (beyond what is consumed in your school)
- ☑ Penalty clauses including termination costs
- ☑ Billing/payment periods.

Feed-in tariffs

A mandatory feed-in tariff is a rate (in cents per kWh) at which the electricity retailers are obliged to purchase electricity from your school's power system.

Some states and territories are in the process of introducing mandatory feed-in tariffs. Check with your installer on developments in your state or territory.

B: Stand-alone solar power systems

If your school…

- needs power for extended hours but you are a long way from an electricity grid, or
- is interested in renewable energy or
- dislikes using diesel, petrol or LPG generators

then…

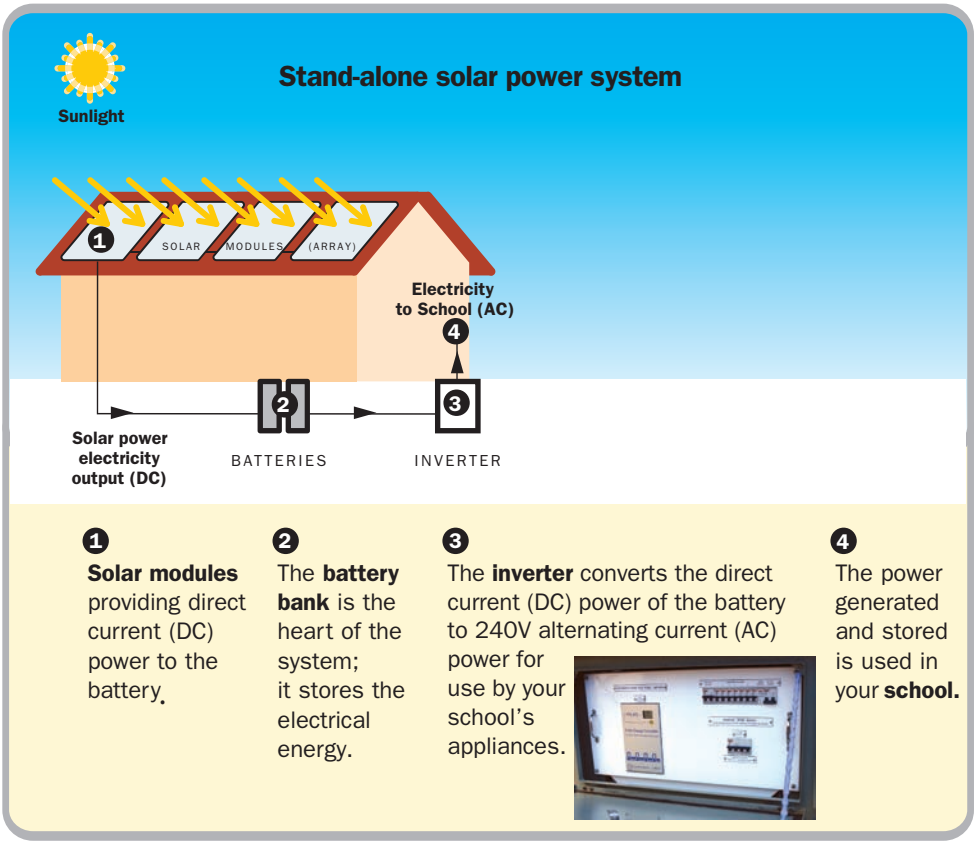
a stand-alone solar power system may be suitable for your school.

A stand-alone solar power system

A stand-alone solar power system is not connected to the electricity grid.

Together, the battery bank and the inverter supply electricity to your school's appliances. Note: If you try to use more electrical energy than the battery bank holds, your school will run the batteries too low and reduce their life expectancy.

The number of solar modules and the size of the **battery bank** can be increased to generate and store more energy, or your school may decide to include a diesel, petrol or LPG **generator**. In areas of high wind, a small **wind turbine** could also be an option. Such systems, which use a variety of generating technologies, are called hybrid systems.



1. **Solar modules** providing direct current (DC) power to the battery.

2. The **battery bank** is the heart of the system; it stores the electrical energy.

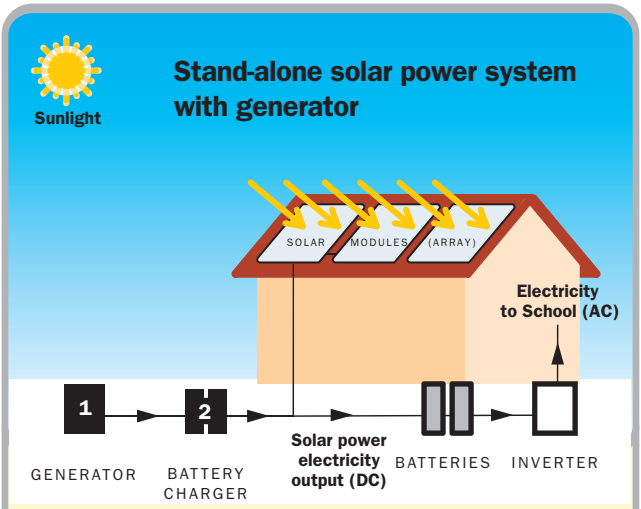
3. The **inverter** converts the direct current (DC) power of the battery to 240V alternating current (AC) power for use by your school's appliances.

4. The power generated and stored is used in your **school.**

A generator and battery charger are normally part of a solar power system so that, when extended bad weather occurs, you have a back-up supply which helps safeguard your batteries.

To reduce load requirements, make sure that all your school's lights and appliances are the most energy efficient available.

A large diesel generator



❶ A petrol, diesel or LPG fuelled **generator** (genset).

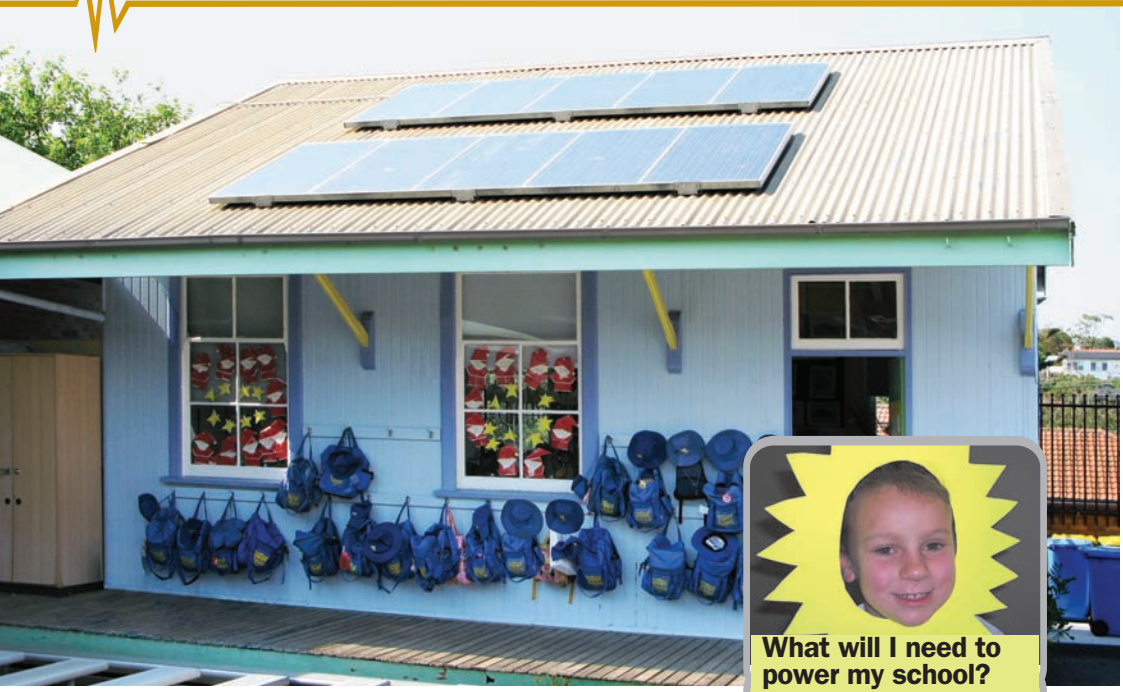
❷ A battery charger to charge the battery on demand.

Generators

The **advantages** of a stand-alone solar power system with a generator is that electricity is available during prolonged periods of overcast/rainy weather, or when big power loads are required. It may also allow for a smaller battery bank and inverter to be used.

The main **disadvantages** are the higher capital cost for the genset and battery charger, and the ongoing fuel and maintenance costs.

System size



What will I need to power my school?

There's no easy answer to this question.

Every school's electricity usage is different—it depends on:

- patterns of energy use in your school
- number of students and teachers
- types of appliances, eg: fridge, hot water system, computers etc. and whether they are gas or electric.

The size of the system will depend on:

- the quantity of electricity your school wishes to consume
- how much funding your school has to invest.

Design

An accredited designer will provide you with the system design and specification.

The system designer will:

- ☑ perform a **load analysis** on the use of your school's appliances and equipment
- ☑ determine the **configuration** and number of solar power modules
- ☑ select an appropriate **inverter**
- ☑ select a suitable **battery bank**
- ☑ select a suitable **genset**
- ☑ **advise** on any other appropriate technologies, eg: solar water heater, wind turbine, etc.

Load analysis

The first step in the design process is to establish your school's electrical loads over an average day using a load analysis.

The system designer uses the load analysis to:

- ☑ calculate the daily energy demand
- ☑ recommend where energy savings can be made
- ☑ determine the peak power demand
- ☑ select the system voltage
- ☑ determine the configuration and number of solar power modules
- ☑ select an appropriate inverter—power output and surge
- ☑ calculate the battery size
- ☑ determine size and type of genset
- ☑ estimate genset use—maximum and minimum run times.

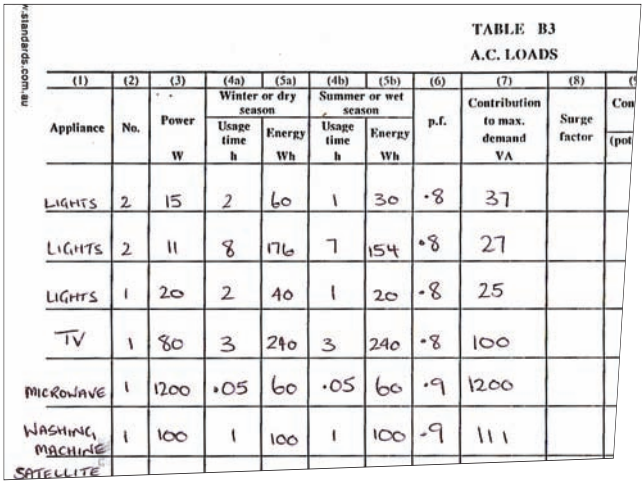


TABLE B3
A.C. LOADS

(1) Appliance	(2) No.	(3) Power W	(4a) Winter or dry season Usage time h	(5a) Energy Wh	(4b) Summer or wet season Usage time h	(5b) Energy Wh	(6) p.f.	(7) Contribution to max. demand VA	(8) Surge factor	Con (pot
LIGHTS	2	15	2	60	1	30	·8	37		
LIGHTS	2	11	8	176	7	154	·8	27		
LIGHTS	1	20	2	40	1	20	·8	25		
TV	1	80	3	240	3	240	·8	100		
MICROWAVE	1	1200	·05	60	·05	60	·9	1200		
WASHING MACHINE	1	100	1	100	1	100	·9	111		
SATELLITE										

An example of a load assessment form

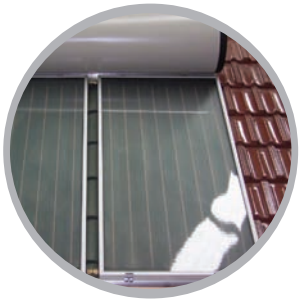
The system design may need to be repeated before an economic and satisfactory 'agreed load' is established.

Reducing demand

It is important that your school considers cost-effective methods of reducing your school's electricity demand.

These methods include:

- using the most **energy efficient appliances**, especially for refrigeration
- **replacing incandescent light globes** with compact fluorescent lamps
- **avoiding quartz halogen downlights**; most are very inefficient
- **switching off stand-by loads** such as those consumed by DVDs and computers
- **utilising sensors**, timers and an automation system



- positioning **summer shading** on west facing windows
- **reducing electricity demand** for space heating and cooling (eg: by dressing for the climate, judiciously setting thermostats, incorporating energy efficiency features into school buildings, such as energy efficient lights, insulation, etc), and
- ensuring there is adequate **solar access in winter** to provide passive heating.

Location

The system's location requires consultation with your accredited installer. Suitable areas are required for the solar modules, inverter, battery bank and genset.

For example:

- the PV modules may be fixed onto the roof, a ground-mounted frame or integrated into the fabric of the building using solar power roofing tiles or windows. For best performance, a north facing area, free from shading is recommended
- ideally the inverter should not be exposed to the elements, though weatherproof models are available
- the battery bank must be in a separate, lockable and well-ventilated battery enclosure
- the inverter and battery charger should also be in a secure, weatherproof and well ventilated enclosure
- the generator should be situated out of earshot and with adequate ventilation
- if system components are located a long way from the school, the cost of trenching needs to be considered.

Orientation, elevation and customisation

Orientation

Solar modules produce most power when they are pointed directly at the sun.

It is important to install them so that they receive maximum sunlight. Ideally they should be in full sun from at least 9am to 3pm. In Australia, solar modules should face north for optimum electricity production.

Elevation

For stand-alone power systems, where winter operation is crucial, the angle should be the latitude plus 15 degrees.

Customisation

If the slope of your school's roof is not ideal, your designer can create a suitable mounting frame to correct the orientation and elevation of your school's array of solar modules. Failing this, the designer can advise you on how much output you are sacrificing from the solar power system.

Average daily production

The following figures indicate the average kilowatt hours (kWh) of energy your school can produce in one day from a stand-alone 1 kilowatt (kW) solar electric power system in various parts of Australia.

Electricity is metered in kilowatt hours (kWh) where 1kWh = 1000Wh. Hence if you use 1kW for 1 hour you have consumed 1kWh of energy. Some electrical retailers refer to 1kWh as 1 unit.

CITY	kWh per day
Adelaide	3.08
Alice Springs	3.62
Brisbane	3.00
Cairns	2.93
Canberra	3.00
Darwin	3.47
Geraldton	3.61
Hobart	2.42
Melbourne	2.57
Oodnadatta	3.70
Perth	3.27
Sydney	2.84
Tennant Creek	3.50
Wagga Wagga	3.12

Quotation

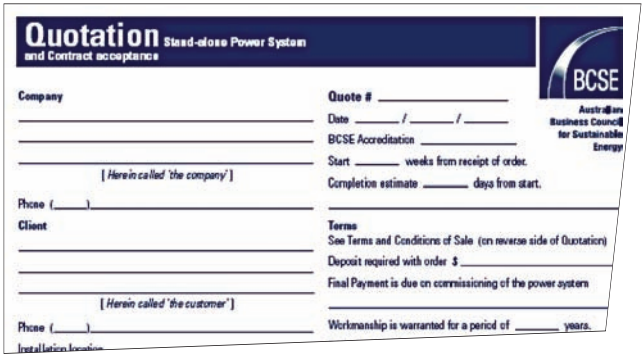
Following the design and specification your school may request a quotation for the supply and installation of the system.

In addition to the **quotation**, a contract for the supply and installation of the power system should be included with each quotation. There is a sample on the BCSE web-site at http://www.bcse.org.au/default.asp?id=96

The **quotation** should provide specifications, quantity, size, capacity and output for the major components, including:

- solar power modules
- mounting frames or structure
- battery
- inverter
- design, travel and transport costs
- installation and other equipment costs
- a battery enclosure
- generator (if required)
- any trench digging
- battery charger
- system user manual.

The **quotation** should also specify a total price, together with proposed start and completion dates. The quotation should form a basis for your contract with the designer/installer.



Quotation Stand-alone Power System and Contract acceptance

BCSE Australian Business Council for Sustainable Energy

Company

[Herein called 'the company']

Phone (____)

Client

[Herein called 'the customer']

Phone (____)

Installation location

Quote # _____

Date ____ / ____ / ____

BCSE Accreditation _____

Start _____ weeks from receipt of order.

Completion estimate _____ days from start.

Terms

See Terms and Conditions of Sale (on reverse side of Quotation)

Deposit required with order $ _____

Final Payment is due on commissioning of the power system

Workmanship is warranted for a period of _____ years.

➔ **Sample of a typical quotation**

The **contract** should include:

- an estimate of the average daily energy output (in kWh)
- the estimated annual production
- the estimated production in the best and worst months
- the responsibilities of each party
- warranties and guarantees, including installer workmanship
- a schedule of deposit and progress payments
- expected operator run times in hours per month.

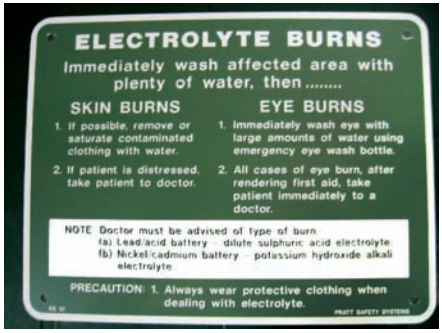
Schools should use accredited installers.

Whilst the initial cost is very important, it is wise to consider all the costs and benefits over the life of the system, including replacement, maintenance and fuel costs.

It is important to remember that a good relationship with a reputable, experienced, accredited installer may be more valuable than a few dollars saved on a quote. The system will be a significant investment so you should ensure the decision you make is the best.

Australian Standards and Industry Guidelines

Stand-alone solar power systems must comply with a range of Australian Standards covering stand-alone power systems, batteries, the installation of solar modules together with *The BCSE Design and Installation Guidelines.*


ELECTROLYTE BURNS
Immediately wash affected area with plenty of water, then .....
SKIN BURNS
1. If possible, remove or saturate contaminated clothing with water.
2. If patient is distressed, take patient to doctor.
EYE BURNS
1. Immediately wash eye with large amounts of water using emergency eye wash bottle.
2. All cases of eye burn, after rendering first aid, take patient immediately to a doctor.
NOTE: Doctor must be advised of type of burn
(a) Lead/acid battery – dilute sulphuric acid electrolyte
(b) Nickel/cadmium battery – potassium hydroxide alkali electrolyte
PRECAUTION: 1. Always wear protective clothing when dealing with electrolyte.

WARNING
SOLAR GENERATION PLANT CONNECTED
ISOLATE SOLAR GENERATION PLANT AT SWITCH BOARD AND SWITCH OFF DC ISOLATOR LOCATED BEHIND BOARD IN GARAGE
PV Array Information
Voc 190 Volts
Isc 10.8Amps

A range of safety signs required under Australian Standards

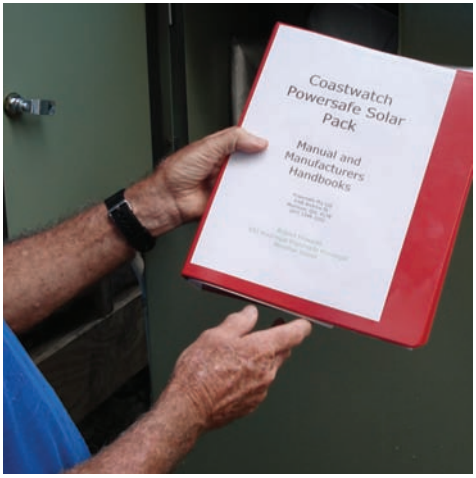
Breakdowns — emergency call out

The system installer should be able to offer a quick response for any major system problems, for instance, equipment failure.

Documentation

A system manual that provides operation, maintenance and safety information should be provided by your installer.

Also ensure you obtain written confirmation of statements made by your installer, performance claims, guarantees and manufacturers' warranties.



Preventative maintenance

After installation, the owner is responsible for ensuring the equipment is maintained in good working order.

This will include checking the water in the batteries, cleaning the solar power modules and visually checking the wiring.

Please note that appropriate instruction by the installer, backed up by maintenance information in the system manual, should be provided.

Safe work practices for any maintenance tasks must be followed.

Maintenance contracts

The system installer can offer a maintenance contract. This will usually include regular maintenance visits, at agreed intervals, to ensure that your solar power system is performing optimally.

Alternative renewable energy resources

Like solar modules that require full sun, all renewable energy devices must have access to a reliable energy source.

There is no point in installing a small wind turbine in a low wind area or a small hydro system in an area prone to drought.

Wind turbines and small hydro

As with solar power, wind and hydro can be used to charge your batteries.

For reliable power, the resource should be located close to your solar power system.

Some schools have sufficient wind to propel a small wind turbine.
Other schools may have access to rivers and creeks to propel a small hydro generator.

Further information

Sections A and B were written to provide you with an overview of solar power systems to enable your school to make an informed purchasing decision.

For more detailed information on the following contents, please refer to the Clean Energy Council website at www.cleanenergycouncil.org.au

Contents on web

www.bcse.org.au/default.asp?id=310

- What is renewable energy?
  — RE resources
- What is a stand-alone power system?
  — Genset only
  — Genset—battery charger—battery—inverter
  — SPS configurations
- Solar modules
- Batteries
- Inverters
- Gensets
- Battery chargers
- Wind turbines
- Small hydro generators
- Input regulators and controllers
- Power and energy
  — Energy services
- Extra Low Voltage (ELV) and Low Voltage (LV)
- Power system quotes
- Australian Standards
  — System documentation

Government

Australian Government
http://www.environment.gov.au/nationalsolarschools

State and Territory Agencies

Queensland
http://education.qld.gov.au/facilities/solar/energy.html

Western Australia
http://www1.sedo.energy.wa.gov.au/pages/solar_schools.asp

South Australia
http://www.sustainable.energy.sa.gov.au/rebates_and_grants

Tasmania
http://www.dier.tas.gov.au/energy/rebates

Victoria
http://resourcesmart.vic.gov.au/for_educators_2425.html

New South Wales
http://www.deus.nsw.gov.au/Energy/Renewable%20Energy/Renewable%20Energy.asp

Australian Capital Territory
http://www.sustainableschools.act.gov.au

Northern Territory
http://www.nt.gov.au

Glossary

BCSE Accredited deemed qualified to design / install by the Clean Energy Council
agreed load production output that matches your budget
array a collection of modules
Australian Standards mandatory electrical safety requirements
automation systems computerised system controlling windows, etc.
battery bank group of battery cells
compact fluoros electrically economical light globe
configuration layout pattern
data-logging system generated data
electricity retailer company selling and buying electricity
elements weather such as rain and sun
excess production power left over after your school's consumption
feed-in tariff price paid for excess power
generator petrol, diesel or LPG powered 240 V electrical source
genset electrical generator powered by fossil fuels
greenhouse gases gases emitted that contribute towards global warming
grid the poles and wires forming a city's electrical network
hybrid using more than one generating technology
incandescent light element that is used in conventional light bulbs
inverter device for converting from DC to AC
kilowatt 1000 watts
kilowatt hours power in kilowatts multiplied by time in hours
load analysis analysis of power requirements
load power requirements
meter meter recording electricity movement
off-peak tariffs incentive to delay power use for quiet time
peak power demand maximum electrical power required
quartz halogen downlights an uneconomical low voltage light
rebates financial incentives offered by governments
runtimes length of generator running time
solar access letting the sunshine in
solar water heater hot water system heated by the sun's energy
solar panel converts solar energy into electrical energy
specification module and inverter models
stand-alone solar PV system power system independent of the mains grid
stand-by loads power to keep an appliance warmed up for a quick start
surge additional power required to start motors
system design number of modules, size of inverter and cables
system voltage voltage of battery and inverter, usually 12V, 24V or 48V
termination costs costs incurred in severing the contract

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